

IN-SITU RADIONUCLIDE MEASUREMENTS

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Radioactive waste storage and disposal practices of the past have created challenging characterization and remedial action tasks throughout the DOE-complex. Historically, information regarding the vertical extent of contaminant migration through the vadose zone has been obtained from core samples and modeling; however, subsequent monitoring of the transport of radiological contaminants through the vadose zone has required coring new boreholes. Routine or continuous monitoring of radionuclide transport in the vadose zone is possible with in-situ technologies. In-situ measurements of radionuclide contaminants will reduce the overall cost of characterization and monitoring.

The In-Situ Radionuclide Assay System (IRAS) consists of hardware and software designed to record near-surface and subsurface radionuclide data in boreholes and monitoring wells. IRAS utilizes a suite of logging tools equipped with radiation detectors to locate, identify and quantify radionuclide contamination. The logging tools have a nominal O.D of 3.5-in. and can be used in any well or borehole with an I.D. of 4.0-in. or larger. The IRAS detector systems are configured and operated to allow for optimal use of field time. Gross counters are used for a rapid assessment of the total radionuclide distribution in the subsurface. The zones in the subsurface yielding anomalously high count rates are then counted using techniques to speciate and quantify radionuclides contributing to the high count rate(s). The logging tools currently in use at the INEEL allow for quantification of most gamma-ray emitting radionuclides such as ^{40}K , ^{60}Co , ^{125}Sb , ^{137}Cs , ^{152}Eu , ^{154}Eu , ^{208}Tl (^{232}Th daughter), ^{214}Pb , ^{214}Bi , $^{234\text{m}}\text{Pa}$ (^{238}U daughter), ^{235}U , and ^{238}U ; additionally, gross beta and quantitative measurements of ^{90}Sr are possible with newly developed INEEL radiation detection technologies. Radionuclide concentrations are reported in pCi/g (soils) and pCi/l (water).

IRAS is ideal for site characterization, verification of remedial actions, and post closure monitoring activities, and provides numerous benefits over conventional water and soil sampling methods. Radionuclide contamination assessment is performed in-situ; there are no samples collected, just data. As a result, large cost savings are realized; no hazardous wastes are generated, there are no samples to ship, and there is no need for costly and time consuming laboratory analyses. It is important to note, however, that in-situ measurements can provide just one part of the big picture. Data from in-situ measurements should be used in conjunction with initial core data and modeling results to accurately predict not only the extent of contamination, but contaminant fate and transport properties for specific sites.